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Runaway beam confinement and dissipation remain one of the main concern for ITER operation and a clear solution has not been found yet. ITER will be provided with a Shattered Pellet Injection (SPI) system as the primary disruption mitigation technique given the promising results provided by DIII-D [3]. To further study such technique an SPI system has been recently installed at JET and to provide reliable results an improved runaway beam position control system [2, 1] is proposed. In this work we propose to use a dynamic observer to estimate in real-time the vertical speed of the runaway beam. This dynamic observer should replace the standard static estimator used at JET by the vertical stabilization system, once the runaway beam is detected. In particular, the instantaneous input/output matrix of the new observer, whose inputs are the magnetic measurements, is equal to the standard observer, meanwhile the dynamic and state-to-output matrices are optimized in order to fit the vertical position reconstructed using EFIT. The new observer has the same high frequency behavior of the standard one plus the capability of detecting the RE beam slow vertical drift. An innovative tool to improve the beam position control is also described. This method uses a graph data structure to store an adaptive probabilistic route-map that links different states of the plasma and that can be obtained either using experimental data or via a simulators. Such structure is then used to estimate an optimal control policy via reinforcement learning techniques.

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